REMARKS

In response to the above-identified Office Action, Applicant seeks reconsideration of the application. No claims have been canceled, four claims have been added and six claims have been amended. Accordingly, Claims 1-10 are pending.

I. 35 U.S.C. § 112

In the Office Action, the Examiner has rejected Claims 1-6 under 35 U.S.C. § 112, second paragraph for various informalities. These matters are believed to be addressed by the amendment submitted herewith. It is therefore respectfully submitted that the rejection under U.S.C. § 112 be withdrawn.

The Examiner indicates that the language "in one or more regions having sizes of the order of 1 micrometer or less are irradiated" recited in Claim 1 is unclear. In response, Applicant notes that this language "in one or more regions having sizes of the order of 1 micrometer or less are irradiated" refers to the selective irradiation of area which individually are of 1 micrometer or less in size. Accordingly, Applicant has amended Claim 1 to clarify that the one or more regions having individual sizes in the order of 1 micrometer or less are selectively irradiated.

II. Claim 1 Rejected Under 35 U.S.C. § 102(b)

Claim 1 was rejected under 35 U.S.C. § 102(b) as being anticipated by Steckl et al. ("Review of Focused ion beam mixing for the fabrication of GaAs based optoelectronic devices", J. Vac. Sci. Technol. B, Vol 13(6) pp 2570-2575 (11/12-1995)). Applicant respectfully traverses this rejection.

It is axiomatic that to anticipate a claim, every element of the claim must be disclosed within a single reference. Thus, if even one feature of Claim 1 is not found in Steckl, the rejection of Claim 1 under 35 U.S.C. § 102 as being anticipated by Steckl must be overturned.

Claim 1 recites a process in which a multi-layer material composed of thin layers is irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV, wherein the irradiation dose is controlled so as to be a few 10^{16} ions/cm^2 or less. By using a beam of light ions having an energy of the order of less than a hundred KeV and controlling the irradiation does to be a few 10^{16} ions/cm^2 or less, mixing of the different layers of the multi-layer material is avoided and the chemical composition of each layer will stay unchanged after the irradiation. In this regard, Claim 1 has been amended to require that the irradiation modifies the composition of atomic planes in the multi-layer material without mixing different layers of the multi-layer material.

Applicant notes that the present invention permits atomic displacements on individual layers, one atom by one atom, such that the chemical composition of other layer will remain unchanged after the irradiation. Accordingly, there is no mixing between the various layers in the present invention; there is only atomic displacements on individual layers. The present invention prevents chemical mixing of the layers; the multilayer structure remains, while the magnetic properties are locally changed.

In contrast, Steckl teaches using a beam of heavy ions (Si^{++} ions). Due to the use of these heavy ions, a mixed region is formed on the irradiated structure in Steckl. Therefore, in Steckl, the multilayer structure disappear, with irradiation, and forms a general mixed region. In fact, the Examiner admits in the Office Action that Steckl uses a beam of Si^{++} ions, which are heavy ions, to form a mixed region as shown in figure 1 (page 3).

In light of the foregoing, Applicant respectfully submits that Claim 1 is not anticipated by Steckl and requests that the rejection of Claim 1 under 35 U.S.C. § 102(b) be withdrawn.

III. Claims 1 and 3-5 Rejected Under 35 U.S.C. § 102(b)

Claims 1 and 3-5 were rejected under 35 U.S.C. § 102(b) as being anticipated by Jung et al. ("Atomic Transport by Ion Beam Mixing in the Radiation Enhanced Diffusion Region", Mat. Res. Soc. Symp. Proc. Vol. 354 pp. 21-26 (1995)). Applicant respectfully traverses this rejection.

Applicant respectfully submits that Jung fails to teach or suggest a process in which a multi-layer material composed of thin layers is (1) irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV and (2) the irradation dose is controlled so as to be a few 10^{16} ions/cm^2 or less, wherein the irradiation modifies the composition of atomic planes in the multi-layer material without mixing different layers of the multi-layer material.

In contrast, Jung teaches using a beam of heavy ions (Ar^+ ions) that modify the chemical composition of different layers of the multi-layer material when it is irradiated. As a result, the irradiation process taught by Jung causes formation of a mixed region and does not permit maintaining the multilayer structure.

Accordingly, Applicant respectfully submits that Claims 1 and 3-5 are not anticipated by Jung and requests that the rejection of Claims 1 and 3-5 under 35 U.S.C. § 102(b) be withdrawn.

IV. Claims 1 and 3-5 Rejected Under 35 U.S.C. § 102(b)

Claims 1 and 3-5 were rejected under 35 U.S.C. § 102(b) as being anticipated by Kanayama et al. ("Fine Pattern Definition with Atomic Intermixing Induced by Focused Ion Beam and Its Application to X-ray Mask Fabrication", J. Vac Sci. Technol. B, Vol 9(2) pp. 296-301 (4/1991)). Applicant respectfully traverses this rejection.

Applicant respectfully submits that Kanayama fails to teach or suggest a process in which a multi-layer material composed of thin layers is (1) irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV and (2) the irradiation dose is controlled so as to be a few 10^{16} ions/cm^2 or less, wherein the irradiation modifies the composition of atomic planes in the multi-layer material without mixing different layers of the multi-layer material.

In contrast, Kanayama teaches using a beam of heavy ions (Kr^+ ions) that modify the chemical composition of different layers of the multi-layer material when it is irradiated. As a result, the irradiation process taught by Kanayama causes formation of a mixed region and does not permit maintaining the multilayer structure.

Accordingly, Applicant respectfully submits that Claims 1 and 3-5 are not anticipated by Kanayama and requests that the rejection of Claims 1 and 3-5 under 35 U.S.C. § 102(b) be withdrawn.

V. Claims 1 and 3-5 Rejected Under 35 U.S.C. § 102(b)

Claims 1 and 3-5 were rejected under 35 U.S.C. § 102(b) as being anticipated by Amaral et al. ("Very Thin Fe/Ni modulation multilayer Films Under Ion Bombardment", J. Appl. Phys., Vol. 81(8) pp. 4773-4775 (04/1997)). Applicant respectfully traverses this rejection.

Applicant respectfully submits that Amaral fails to teach or suggest a process in which a multi-layer material composed of thin layers is (1) irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV and (2) the irradiation dose is controlled so as to be a few 10^{16} ions/cm^2 or less, wherein the irradiation modifies the composition of atomic planes in the multi-layer material without mixing different layers of the multi-layer material.

In contrast, Amaral teaches using a beam of heavy ions that destroy and modify the chemical composition of different layers of the multi-layer material when it is irradiated. As a result, the irradiation process taught by Amaral causes formation of a mixed region and does not permit maintaining the multilayer structure.

Additionally, Applicant notes that the dosages indicated in Amaral are presented as causing mixing. The doses used in Amaral are of 10^{17} ions/cm^2, which is greater than the irradiation dose set forth in Claim 1.

Furthermore, Amaral teaches away from the use of the light ions such as He^+ ions because in the Amaral reference, He^+ ions are presented as being "less effective". In this regard, Amaral discloses that mixing with Ne is "more effective than with He^+ ions of similar dose."

In light of the foregoing, Applicant respectfully submits that Claims 1 and 3-5 are not anticipated by Amaral and requests that the rejection of Claims 1 and 3-5 under 35 U.S.C. § 102(b) be withdrawn.

VI. Claims 1 and 2 Rejected Under 35 U.S.C. § 103(a)

Claims 1 and 2 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Steckl. Applicant respectfully traverses this rejection.

Applicant respectfully submits that Steckl fails to teach or suggest a process in which a multi-layer material composed of thin layers is (1) irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV and (2) the irradation dose is controlled so as to be a few 10^{16} ions/cm^2 or less, wherein the irradiation modifies the composition of atomic planes in the multi-layer material without mixing different layers of the multi-layer material.

As noted above, Steckl teaches using a beam of heavy ions (Si^{++} ions). Due to the use of these heavy ions, a mixed region is formed on the irradiated structure in Steckl. Consequently, in Steckl, the multilayer structure disappear, with irradiation, and forms a general mixed region.

Accordingly, Applicant respectfully submits that Claims 1 and 2 are not obvious over Steckl and requests that the rejection of Claims 1 and 2 under 35 U.S.C. § 103(a) be withdrawn.

VII. Claims 1-5 Rejected Under 35 U.S.C. § 103(a)

Claims 1-5 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Amaral. Applicant respectfully traverses this rejection.

Applicant respectfully submits that Steckl fails to teach or suggest a process in which a multi-layer material composed of thin layers is (1) irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV and (2) the irradation dose is controlled so as to be a few 10^{16} ions/cm^2 or less, wherein the irradiation modifies the composition of atomic planes in the multi-layer material without mixing different layers of the multi-layer material.

As noted above, Amaral teaches using a beam of heavy ions that destroy and modify the chemical composition of different layers of the multi-layer material when it is irradiated. As a result, the irradiation process taught by Amaral causes formation of a mixed region and does not permit maintaining the multilayer structure.

Accordingly, Applicant respectfully submits that Claims 1-5 are not obvious over Amaral and requests that the rejection of Claims 1-5 under 35 U.S.C. § 103(a) be withdrawn.

VIII. New Claims 7-10

Applicant respectfully submits that the New Claims 7-10 are supported by the original disclosure.

With respect to Claim 7, Applicant incorporates its prior arguments with respect to its base Claim 1. Additionally, Applicant respectfully submits that the cited references fail to teach or suggest a process in which a multi-layer material is irradiated by means of a beam of light ions comprising He^+ ions.

With respect to Claims 8-10, Applicant incorporates its prior arguments with respect to their base Claim 1.

Therefore, Applicant is of the opinion that New Claims 7-10 are allowable.

CONCLUSION

In view of the foregoing, it is submitted that the claims are in condition for allowance. Reconsideration of the rejections and objections is requested. Allowance is earnestly solicited at the earliest possible date. If there are any fees due in connection with the filing of this response, please charge those fees to our Deposit Account No. 02-2666. If a telephone interview would expedite the prosecution of this Application, the Examiner is invited to contact the undersigned at (310) 207-3800.

Respectfully submitted,
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Dated: April 5, 2002

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: BOX FEE "Amendments", Commissioner for Patents, Washington, D.C. 20231, on the date shown below.

Linda D'Elia April 5, 2002

Attachment: Version with markings to show changes made

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

On page 1, after line 2, the following heading has been inserted:
BACKGROUND

On page 1, after line 3, the following heading has been inserted:
Field of the Invention

On page 1, line 17, the heading PRIOR ART has been deleted, and Description of the Related Art has been inserted.

IN THE CLAIMS

The claims have been amended as follows:

1. (Amended) Writing process on a multi-layer material composed of thin layers, in which said material is irradiated by means of a beam of light ions[, such as He^+ ions], having an energy of the order of or less than a hundred keV, [characterized in that this] wherein the material is a thin-layers material comprising buried layers deposited on a substrate, [in that] wherein one or more regions having individual sizes of the order of 1 micrometer or less are selectively irradiated, the irradiation dose being controlled so as to be a few 10^{16} ions/cm^2 or less, the irradiation modifying the composition of atomic planes in the material at an interface between two layers of the latter without mixing different layers of the multi-layer material.

2. (Amended) Process according to claim 1, [characterized in that] wherein the irradiation is carried out through a mask.

3. (Amended) Process according to claim 1, wherein the writing process is adapted for the magnetic or magnetooptic recording of binary information, [especially] for the production of discrete magnetic materials, of magnetic memory circuits or of magnetically-controllable logic circuits, or for the production of sensors [characterized in that it employs a writing process according to one of the proceeding claims].

4. (Amended) Process according to claim 1, wherein the writing process is adapted for optical [Optical] recording process of [the] a read-only memory type[, characterized in that it employs a writing process according to either of claims 1 and 2].

5. (Amended) Process according [to either of claims 5 and 6] claim 1, [characterized in that] wherein the recording material is a magnetic multi-layer material, the individual layers of which are pure metals or transition metal alloys or rare earth alloys.

6. (Amended) Process according to claim 1, wherein the writing process is adapted for producing magnetically-controllable optical circuits using a controlled variation of the optical index component associated with magnetism[, characterized in that it employs a writing process according to either of claims 1 and 2].

New claims 7-10 have been added.